Operators and autonomous intelligent agents: human individual characteristics shape the team's efficiency

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“Agents’ cooperation with external entities, and in particular human operators, is considered as one of the thirteen major research challenges for autonomous cyber-defense” (Theron and Kott, 2019).
Issues on operator-AICA collaboration

**Hypothesis**

Individual characteristics of the operator will influence the acceptability and the confidence they have in the AICA.

**Experimental method**

Investigating interaction phase before the deployment of an autonomous intelligent UAV (definition of an initial strategy to supervise the integrity of the system, and how the intelligent agent is supposed to manage new threats).
Micro-world to test operator-agent collaboration

HMI for preparing the mission of the intelligent agent.
Metrics

20 Participants x 20 missions = 400 measures

Metrics of the operator's feelings about the chosen solution.
- Feeling of authorship of the validated solution, i.e. according to the operator who of him or of the system took the most part in its design.
- Feeling of responsibility in the validated solution.
- Confidence in the validated solution
- Cognitive workload

Metrics for individual characterization of operators.
- The Big-Five Inventory (BFI-Fr), which describe the personality in five central traits: openness, conscientiousness, extraversion, agreeableness, neuroticism.
- The Rosenberg's Self-Esteem Scale (RSES), measures individuals' self-esteem
- The Self-confidence Stability Scale (SESS) measure the variability of individuals' self-esteem over time
Variation in operator's feelings about the chosen solution

Score of operators on feeling metrics

Clustering of participants
(a) Hierarchal upward classification with k=2 groups

(b) Principal component analysis

<table>
<thead>
<tr>
<th>Participant</th>
<th>Responsibility</th>
<th>Confidence</th>
<th>Authorship</th>
<th>Workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.0</td>
<td>6.6</td>
<td>3.5</td>
<td>55.0</td>
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<tr>
<td>2</td>
<td>4.0</td>
<td>6.7</td>
<td>3.4</td>
<td>28.3</td>
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<tr>
<td>3</td>
<td>4.7</td>
<td>5.6</td>
<td>3.6</td>
<td>35.0</td>
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</table>
Link with the individual characteristics of the operator

Personality of participants according to metrics for individual characterization.

P-values associated to the correlations with sense of responsibility and authorship

<table>
<thead>
<tr>
<th></th>
<th>Extraversion</th>
<th>Agreeableness</th>
<th>Conscientiousness</th>
<th>Neuroticism</th>
<th>Openness</th>
<th>Self esteem</th>
<th>Self confidence stability</th>
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</thead>
<tbody>
<tr>
<td>Responsibility</td>
<td>0.031816</td>
<td>0.538272</td>
<td>0.614712</td>
<td>0.949400</td>
<td>0.185194</td>
<td>0.544530</td>
<td>0.088695</td>
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<td>Authorship</td>
<td>0.141960</td>
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</table>
Challenge
AICA will involve interactions with human operators for defense preparation or reporting.

Method
We investigated operator-AICA interaction phase to set up deployment.

Result
Strong inter-individual variability in operator’s experience (responsibility, authorship), linked to personality features.

Conclusion
Operators’ characteristics shape the team efficiency between operator and agent and should be considered during the AICA design process.
Thanks for your attention